A Watered-down Topographic Map **Video Transcript**

C.= Connie Leverett (Teacher)
B.= Bill McElroy (Academic Dean/Assistant Principal)
S.= Any one the students in the class

C. I'm Connie Leverett. I'm a high school marine biology teacher here at Wando High School.

B. My name is Bill McElroy. I'm the Academic Dean here at Wando High School, which is basically the assistant principal for curriculum. Wando is a comprehensive high school. We have approximately 3000 students here and a staff of about 280, which includes 180 teachers. We're obviously located in Mount Pleasant, South Carolina, which lends itself very nicely to some of the curriculum that Ms. Leverett works on for marine science because of our proximity to the ocean and the ability for kids, a lot of who grow up around here to be familiar with the ocean and the dynamics that go with that, so we're real excited about the curriculum she teaches.

C. I have been teaching science for 22 years. I got a biology degree and then I decided to teach school and I've taught everything except physics. And I love marine biology. It is my favorite. I've always just tried to incorporate it into a number of different areas, especially physical science and biology. This particular class is a really nice mixture of students. Many of the students in this class are 11th or 12th graders. In fact there is a majority of seniors in this class. And it's a very important class for them to get their credits. It's considered a lab-based science and that's a science that they are required to have at least 3 credits of in order to graduate from high school and/or very often they have to have 3 to 4 credits of lab based science to get into the different universities that they want to go to.

C. Overall these students come into marine biology with, they've already taken physical science and biology. Those are the two basic requirements. Some of them are taking chemistry at the same time.

C. With this particular lesson the students at the beginning of the year, we start off with plate tectonics and one of the curriculum areas that I am working on with this particular class is to revise it by using the ocean literacy topical areas. In ocean literacy one of the things that you look at are all the different features and how those determine the types of organisms and ecosystems that exist.

C. For this particular lesson one of the goals I wanted was to revisit different features on the ocean floor. We're going through a survey of the animals right now and I wanted to revisit the invertebrates but from a standpoint of looking at ecosystems, like vent systems, and in hydrothermal vents you usually have a large number of invertebrates and we're kind of coming to the end of the invertebrate part of our survey of animals. But I also wanted the students not just to look at the animals totally separate and apart from the fact that they exist in these systems because of the formations within which they are formed.

C: You guys ready. Let's go. Today what we are going to do is to differentiate between topographic maps and bathymetric maps. What is the difference between topographic maps and bathymetric maps? Anybody know? We are going to learn about it today so if you don't know, fine.

S. Topography

C What is topography?

S Changes in elevation.

C Changes in elevation. Right. It shows you changes in elevation on land. So I wonder what bathymetric means?

S. Changes in depth in water

C. Ooh, he's good. Changes with depth in water. Do you ever use charts when you are out fishing? OK do you use charts and everything? Why am I calling it a chart? Why don't they just call them maps? Right?
And whenever you use the word chart you are talking about bathymetric or someplace out in the ocean. Or in our case a lot of times the creeks and things of that sort too.

C. OK so what we're going to do today is to go over those types of things. We're going to tie that in to the kinds of animals that we've been looking at as well. And one of the ways that we are going to tie that in is that my favorite group that we haven't covered quite yet is the vent organisms. OK? And out of those four areas that are under the water and everything-seamount, ridge/bank, rift, submarine canyons. These are all features that we find in the ocean. Do you recall some of the ones that we have gone over before?

S. Seamount.

C. Seamount. Right. What is that Cade?

S. It's a mountain under water.

C. It's a mountain under water. Right. It's volcanic mountain that is under water. Does anybody know; we haven't really talked about ridges and banks. Do you know what those are?

S. It's like a drop off, isn't it?

C. Right it can be kind of a drop off at times. Not always. There are all kinds of different shapes of these.

C. How about the mid-ocean ridge? What's the one we talked about a lot?

S. The Atlantic

C. The Atlantic. Right, Anthony. The Mid-Atlantic Ridge.
And the submarine canyon. Do you recall what that is? What's a submarine canyon?

S. A trench. S. Underwater canyon.

C. It's an underwater canyon. Why's it underwater now?

S. The world flooded.

C The world flooded. Why? What happened? What melted?

S. Glaciers

C. Right. Glaciers melted and covered these canyons that had formed just like the Grand Canyon but now they've been covered by water and there is one along our east coast that we'll be looking at.

C. OK. So you're going to make four different models, but everybody's not going to make all four of them. Each group is going to make one of these models. OK. And you're going to be using little Tupperware containers. All right. You'll take this Tupperware container. Now before you actually get started you're going to take some clay and mold your clay using some instructions that are at the tables. You are going to mold your clay into one of those features. OK? You want to mold your clay outside of the Tupperware container, not inside. That would be too hard. Then you're going to want to take your ruler and you're using the metric side of the ruler, which is centimeters. You want the deepest; so you want the largest number at the bottom. Don't put "1" at the bottom; put the largest number at the bottom. And the different rulers go up to different numbers. And then I put my structure inside this container. This is my ocean, right here. OK? Then you take--on the instructions it will say acetate and that's a transparency--acetate is just an old word. You'll take your transparency and then you'll cut it. You'll tape this to the side; you'll cut your transparency so that it fits over this container and you'll tape it as well. There are also some other instructions for putting funnels along the side of it; and those funnels will be used to put water in because what you'll be doing is putting water at different depths so that we can show the different depths and how this feature would look on a map. OK. You want to make sure. This is something the last class forgot to do. Make sure--in the instructions it tells you to put the actual numerical value of the centimeters that you are using along with each line that you make on this transparency. OK-don't forget to do that because that also helps to be able to read the maps that you guys are going to be making. Allrighty? One more question.

On your map you are going to see things like this while you're making them. Now if you saw something like that on a map. Do you have any idea what that would be? On your map? Big circle.

S. A lake.

C. It could be a lake. What else could it be?

S. Sink hole. C. A sink hole.

S. A hole in the map.

C. Anything else?

S. A pond

C. A pond. It could be a pond

S. A neighborhood.

C. What if I drew it up like this? What if along the sides, there was something like this and you could see that. And you know what a great artist I am. Then what would it be? If it had sides to it and it came up like this...

S. Mountain

C. Now it's going to be a mountain, isn't it? What you guys are doing is you're doing something that is two-dimensional; you're showing that in a two dimensional form and people are looking flat down on that two-dimensional form. In order to be able to see that two dimensional form, as you're add water, you're going to be drawing little circles along where the water line is. OK? So as you draw these different lines, someone else should be able to look at your map drawing and determine which of these features they're looking at, which of those oceanic features they are looking at.

C. Let me give you guys copies of the activity.

C. All of us adults and kids need to have very specific instructions clarified for us. All of us need time to soak in what it is that we are about to do.

C. OK you guys take about 3 to 5 minutes and read over the instructions. I have a couple of other pointers just to give you to make sure were all on the same page before you go back and do your lab.

C. Here are some things I need to make sure that you understand. First of all, your particular description, the seamount, ridge/bank, rift, submarine canyon. That's going to be at your table.
If you are reading the instructions, you will notice on the back page that it says if the structure is flat to go up about every .5 centimeters, every half of a centimeter versus going up 1 centimeter if the structure is steep. Now which of these structures would you consider to be flat? Which of these would be flat? There are 2. Not the seamount. It's flat on the top but it's fairly steep going up, isn't it? This is going to be more flat, so this one you want to go up every .5 centimeters. This one you'll go up every 1 centimeter. And how about this one? This is like a mountain range, isn't it? That's not flat, so this one you'll go up every 1 centimeter. What about submarine canyons? Submarine canyons are fairly flat. They just have this indentation right down the middle of them .So once again this one will go up every .5 centimeters. I can tell you right now that the people who are doing the submarine canyon and the mid-ocean ridge; it's going to take you a little bit longer, all right to get yours done. So what we'll be doing whenever we get through is that each group will get one laptop and you'll go to that web page-oceanexplorer.noaa.gov. Go to photo gallery. It's just underneath on the right and then click on maps and start looking for your feature, an actual example of your feature, OK in those maps.
One of the things I noticed that people also was that whenever they made a seamount they didn't give it-they made it straight up-instead of giving it a little bit of slope and it's very difficult to see any change in water when you are looking straight down on something if it's a total exact cylinder. So give it a little bit of slope like it's a little mountain. OK.
Conner asked a really good question. He said Ms. Leverett, do we have to go all the way up to 15 centimeters? and no, you want to go up to about 6 centimeters total height for your additions of water depending on which feature you have.
I think that's it, you guys. Do you have any questions before we begin?

C. One of the things that I noticed about this particular lesson was that there's a lot of molding of clay, working with clay. That's all right-it's good for students; it's good for them to be kinesthetic. We often avoid that. We sometimes in high school tend to be too far on the technology end.

C. When you think of this long ridge going right up through the middle of the Atlantic; it's continuous. Thank you very much. You want it to go from this edge to all the way over here.
Here's the other thing. Let's look at this. Is that how you think the ridge would overlap, like that? Here's your volcanic middle, right here. So if this is the volcanic middle we want to sort of see that, don't we. So tell me what I would do with my sides here, once I've gotten them flattened so that they go continuous from side to side. Where would they touch this? Yes, ma'am.

S. So it doesn't touch the side; so it's fine. So you need to trace it, just go around the edges of the clay looking straight down.

C. Go a half centimeter at a time. Will do.

S. Keep going-just a tad more. Half a centimeter. Is that good? Yeah. That's good. It's at an angle.

C. Look down. I think it changed.

C. Good.

S. It's up on top now.

C. So whatever your last value was, start with that.

S. So re-draw it? It has to get smaller.

S. Remember we did it to 2 centimeters. After we did the 1 centimeter, we did it up to 2 centimeters and that's this right here.

C. That's your 2 centimeters?

S. I labeled the 2 centimeters right after I did it. .Maybe we didn't stand right above it or look at it from the same angle.

C. But you know what. Do exactly what you have and go with the data that you have. Because that's really important because if you have to go back and re-do; there's no reason to make up data. There's no reason to do that. It's important to go ahead and stay with what you have and do your best at labeling each of these lines and we'll talk about that, about how it is difficult sometimes to see what's going on unless you are looking straight down on it. It's important to label it as you are going too isn't it? But you guys the map itself, you can tell that it's a seamount. You can tell it's a little mountain, can't you? Nice.

S. You have created a bathymetric map of a mount.

C. Here's what I would have liked to have suggested. In your instructions it said to write down the centimeter value; it was a little confusing because they also talked about do it to this depth. Wherever your 14 was, whichever line was the 14, write it on there.

S. This line-It moved from the original.

C. As you're adding water, the depth of the water increases. And so instead you have a circle like this and the water has gone up and it's like this.

C. One of the things that I learned in my science methods class was that it was really important not to go through and tell students do this; do this; do this. Sometimes you have to do that, but as often as you possibly can, it's really important to ask questions so that they're thinking and that they become engaged. And it becomes theirs; it's their responsibility--not just you. By going around the room and asking students, having students ask me questions, and then if the question was one where they just needed a detail, then answering that. But if the question was one like, for instance, whenever the girls and the guy who were doing the ridge, when they showed me their sample. Instead of just saying "Do it this way!" it was important to stop and make them connect to the structure we were looking at and really think holistically about that structure and how their model really was not that structure. And when they began describing it to me and I began to ask them, what did it look like? Why was it this way? Probing them so they would begin thinking the same kinds of thoughts that I'm thinking but they're actually doing the processing and not just me. That way they get involved with the thinking and the learning and they'll remember it better.

C. One of the things that I tried to do to make the lesson a little more sophisticated for 11th and 12th graders, because even 9th and 10th graders are not as sophisticated as 11th and 12th graders, which is primarily the kind of audience that I have, was to incorporate the laptops and the use of the technology and the web page because then that way students are actually able to look at the really sophisticated bathymetric maps that NOAA has produced. And it gives them an application that's a little more sophisticated as well.

C. One of the things that I've noticed with students these days is that they are very used to integrating the web into their lives. And what I realized is that is part of the reason why it's so important to integrate any type of Internet pictures and information, especially whenever it's very good information like the NOAA web site. The other thing that's important about the NOAA web site is that once again it takes these features and instead of just having a static content area, you now can apply this information to what's going on in the real world with these explorers. And I’m really trying to make sure that I make connections for students in all these areas.

C. Some people are very good spatially and some people are not. So how would you explain to someone that this is a seamount? Sarah Anne, How would you explain that?

S. You can tell that the water level is going up but not that steep.

C. We went from 14; we got to 12 here. Right? It's deeper outside and it's going up like this, isn’t it? and when you start doing that. If you take it this way and flip it this way; then what you've got; you’ve got is something like a mountain. And out of our first choices this is the only one that is a true single mountain, isn't it? OK. But ask questions if you don't understand.

C. Robert and Preston and Josh. OK, you can't see the numbers, so I’ll call them out to you.

S. It's a ridge/bank

C. So we're going from 14.5 right here, (am I saying this right Robert?). This one is 14.5, right there, OK. This one inside, like this little area here is 14.And this is 13, right there. This one is 12.5. OK so. Where was the first line? Which number?

S. 14.5.

C.14.5. The water came up to this area and then they added more water and it came up, and came up in here. What are these little structures?   You guys don't tell because they had a real neat ridge/bank. What are these little structures right here?

S. Sea fans.

C. What? Sea fans. Hmm. I'm not sure that they would make this nice little circle.

S. Islands

C. They could be little islands. Under the water like this and everything. You guys want to tell them what they were or do you want to make them think a little bit longer.

S. Volcanoes

C. Volcanoes, except that a volcano would probably have a few more little concentric circles, wouldn't it.

S. Rocks?

C. Rocks. Conner made Robert tell him what they were. So these are rocks here that they put. So now we go in and we've got 13 here so the water is rising. It's risen over the rocks hasn't it? And it's doing what? We are getting more and more shallow as we go this way. Can everybody see that?

C. Let's do this one all right. Take a look at what they did.

S. It's a submarine canyon.

C. It is a submarine canyon. Tell me why you think that. Is it labeled on here somewhere? Did I miss that? Where does it look like a canyon? Which part? Come up here and point it out. Come up here and show me which is the canyon part. Write "canyon" on it. Point to it first. OK -good. This is the area; here's the canyon here. Here's the continental shelf up in this area.

And the canyon's going through and here's the open ocean. All right-now. Do you see what Cade just mentioned to me? What is incorrect about this bathymetric map? What's incorrect about their numbers? Look at the numbers. Right here they've got a quarter of a centimeter, then they go to a half of a centimeter, then they go to 4 centimeters. They went by half centimeter intervals. They went half here; then 1; 1 and a half; 2.

S. They did it backwards.

C. How did they do it backwards, Josh? What do you mean?

S. Because the deepest part they wrote as the shallowest part.

C. Yes the deepest part they wrote as the shallowest part. Look right here. Josh, explain to me how you know that.

S. That's supposed to be the deep end.

C. Here's the shelf up here. Here's the ocean. This is the deep area down here, isn't it? So this is the first part that started to fill in. So this is the deepest isn't it? What they've got is they have it labeled as quarter and half centimeter. This should have been what? This should have been the deep part-four centimeters and then going backwards up to a quarter or a half, whatever this one would have been. OK-.5 Now does everyone see what I am saying? Do you understand what I'm saying? Because this is the ocean, right? Whenever these canyons were not submerged and the glaciers hadn't melted yet, the way that Cade and they labeled it would have been correct. Wouldn't it have? The way they labeled it would have been correct because then it would have shown a land feature and this part of the feature would have been the highest elevation so it would have had the highest number but in the ocean, whenever we are labeling these charts, it is just the opposite because we want to show the depth.

C. What would be zero on all our maps? The sea floor? What is the top? What do we call that? Right here in the Low Country, we say that we are below it, but we're really not. Sea level, right. That's where your zero mark is and you start getting higher from that and then of course deeper from that as well whenever you're going in the ocean.
OK-so this is our submarine canyon.

C. I was so excited when Cade gave me his contour map and it was wrong and it was really neat because he recognized that the numbers were wrong and I was so excited because I thought what a wonderful discrepant event built into the lesson without my even having to ask for it. And whenever he said Oh Ms. Leverett, I’ve got the numbers wrong, I had seen that and I thought that this is such a great kid I hate to, in front of all the cameras, say to the class should these numbers be like this? Or should they be the other way? And whenever he volunteered that information, it then allowed me. He volunteered the information but he did it in such a way that it allowed me to ask the class to be able to differentiate between a topographic map, if this was a topographic map, versus a bathymetric map, which was the whole goal of the lesson.

C. Most of them understood their features very well because we had seen pictures. They had looked at them on other maps and so they were familiar with those. The submarine canyon though they were not familiar with. And even before they began I should have shown them a picture of that, which is why it was important to stop and look on the web and make sure that they could visualize this particular feature because just reading the instructions was not adequate.

C. Let me ask you guys something. Can you define contour lines, topographic maps, and bathymetric maps in your own words?
OK now take a look at that. What is that a feature of?

S. Seamount.

C. OK-good. And you can see that it is this little mountain; it's got a little flat top. There's a seamount. There we go. Thank you. Thanks Jordan. Take a look at this. This is showing one of the devices that are used to actually do bathymetric mapping now. And it's a scanner. A sonar scanner. And they are dropping it off the back of this boat, this NOAA vessel. All this wonderful color enhancement. What kind of feature is that? It's a ridge. Look at that. When we look at hydrothermal vent situations and we start looking at those different organisms that are so cool in all those different areas; then I want you guys to think of these different types of features.

C. OK. Where is this? Blake's Ridge?

S. Atlantic Ocean

C. And it's right off our coast, isn't it? Here we are, right here

C. OK. I need definitions. I need definitions because you need definitions in order to make 100 on your quiz. Give them to me. Tell me what a contour line is.

S. A line around edge

C. All those little lines where the water was. That's what those were. What makes it a contour line though? What Gabby?

S. It's a continuous line.

C. It's a continuous line. And what do we have to put on a contour line so that it has meaning for us?

S. Measurements
C. Measurements-depth and/or height

C. Now tell me topographic map versus a bathymetric map. Which one is going to be in the water?

S. Bathymetric

C. Bathymetric map is the one in the water, right!
So this one is land and this one is going to be in water.

C. Tell me. Use these words to help me define it. Use the words sea level, and either depth or height, and contour lines. Put these altogether and help me come up with the definition.

S. Topographic shows elevation.

C. Topographic shows elevation. Relative to what? Elevation relative to sea level. And it shows that with contour lines, right?

C. Bathymetric. Shows what? Shows depth relative to

S. Sea level

C. Sea level, good. Topographic and bathymetric.

C. One of the quick and dirty assessments that I plan on doing and we didn't get to it today was to give them a very easy definition type question, which is a real knowledge based, content type question. With something like this where they are using two terms that seem-for those of us who have used those terms a lot, they seem very easy. But just making the differentiation between the word topographic and bathymetric. It's important for them to get those straight. So you sort of have to stop in any kind of building of knowledge, sometimes we have to start at the very basic, the knowledge base. That's going to be the first thing I am going to do tomorrow when they come back into class we're going to have a real quick assessment based on just the vocab. Then the next thing that we'll do is to actually look at the harder part, the application of these different types of contour maps and ask them to identify different structures within a map. By going through and asking ahead of time, it gives them the idea this is what we are focused on and then actually doing the information, actually doing the lab and everything, finding out and letting them construct what those maps are, gives them examples. Then once you have done that, to process that again and actually come up with definitions. They basically came up with exactly what topographic and bathymetric maps were but I had guidelines in which for them to work. I told them to use these particular words that we had begun to understand instead of just having it totally open ended. It's a little more of a guided inquiry. I found that people don't get as frustrated if you give them guided inquiry versus just totally open ended inquiry.

Tips for Teachers

Connie Leverett First of all, the first thing I would suggest as far as preparation of materials is start getting your modeling clay early because Wal Mart will sell out of that and then you'll be stuck trying to hunt all over the place for it. And the other thing is when you are looking at containers and things of that sort to go ahead and find yourself a quart container, find some that might work. And look at this video to see what worked. There are a lot of quart containers that you can use, quart containers that are at least 6 centimeters in height. Trying that out is something else you should make sure that you do. I made sure that I got my modeling clay and my quart containers, both types that I bought and simulated each of the models at home on the kitchen counter prior to doing the lab.

One of the things that I thought was a great suggestion was one of the students said to me "we should be using blue water." I think I am going to put blue food coloring at everybody's table because there is no way for me to have enough blue water on hand ready for them to use but they can just drop some food coloring in that (we'd have to talk about how you can't get it too blue). But by having the water a different color--a lot of them could really not see where the water line was. And again that is more of the kinesthetics interfering with them learning about contour maps, rather contour lines. So by coloring the water they would be able to see it a little bit better.